***CANDY DNA REPLICATION LAB***



In this activity you will be making a DNA double helix out of candy and using it to model the process of DNA Replication.

**Materials:** 24 big marshmallows, 24 small marshmallows, 4 different colored gumdrops (you will need 3 of each color), 72 toothpick halves (or 36 whole)

**Procedure:** Note: Be sure all of your candies remain on a paper (not on a desk), and that your hands are clean if you intend to consume your models after finishing.

1) Two of the major enzymes involved in the process of DNA replication will be represented in this activity. Assign one person in your group to act out the role of the Helicase enzyme, and another person in your group to act out the role of the DNA Polymerase enzyme. Record these roles on your data sheet.

2) Obtain/ count all lab supplies. Inform your teacher if you are missing any materials.

3) Use a plastic knife to cut each gumdrop into 2 equal/ symmetrical halves. Make sure you now have 24 gumdrop halves (6 of each color).

4) DNA is found in the nucleus of eukaryotic cells, so this entire lab must be done in that cell part. Use a piece of paper to represent the nucleus for your DNA. Now, assign one Nitrogenous base to each of the 4 colors. Record it on your data sheet.

5) Prepare six individual nucleotides: Use toothpicks to connect one small marshmallow to one large marshmallow. Then add one N-base gumdrop perpendicularly to the large marshmallow. Draw/ label/ color one of your nucleotides on your data table and answer questions 8-10.

6) Assemble nucleotides into a polynucleotide strand by connecting the large marshmallow of one nucleotide to the small marshmallow of another nucleotide. Continue until a strand of six nucleotides has been constructed. Once this is completed, all of the large and small marshmallows should be in alternation in a straight line; the gumdrops should be sticking out at a perpendicular angle from the large marshmallow.

7) Now you will need to assemble a DNA strand which is complementary to the strand which you have already built. Place the second strand next to the first so that the bases touch. Be sure this is done in an antiparallel direction. You now have a complete molecule of DNA. (\*Hint: In order to be able to complete this entire activity, you will need to use 3 of each N-base in your parental strands of DNA).

8) On your data sheet, make a detailed/ colored drawing of your DNA double helix. Be sure to include a detailed key. Use a highlighter to circle 1 nucleotide. Answer questions 12-18.

9) To demonstrate replication, first make 12 more nucleotides with the same nitrogen bases as the first 2 strands. These are nucleotides floating around the nucleus. Spread them out on your nucleus to demonstrate this. Draw this on your data sheet. Answer question 20.

10) In step 1 of the lab, one person decided to play the role of Helicase. This person should now “unzip” the 2 parental strands of DNA. STOP when you have unzipped 4 base pairs. Draw this structure on your data chart, label Helicase and the Replication fork. Answer questions 22-23.

11) Helicase should now finish separating the 2 parent strands of DNA to make 2 templates. In step 1 of the lab, one person decided to play the role of DNA Polymerase . This person should now add the appropriate nucleotides. Remember: the leading strand replicates continuously in the direction that replication is occurring, but the lagging strand replicates in fragments in the opposite direction. You have now finished replicating your DNA! Draw your newly synthesized DNA molecules on your data sheet. Label both parent strands (the strands that came from your original model built) and both daughter strands (the 2 new strands). Then answer questions 25-33.

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per \_\_\_\_\_\_\_\_\_\_\_



***CANDY DNA REPLICATION LAB- Data Sheet***

*Prelab Questions:*

1. What is a monomer of DNA called?
2. What are the 3 parts of the nucleotide?
3. What are the 3 major enzymes that play a role in the process of DNA replication?

*Lab Questions:*

1. Who will play the role of Helicase? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Who will play the role of DNA Polymerase? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Gumdrop color for Nitrogenous bases:

 Adenine = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Thymine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Cytosine = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Guanine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Draw/ label/ color one of your nucleotides below:
2. Describe the marshmallow that represents the phosphate group.
3. Describe the marshmallow that represents the sugar.
4. How did you know which is which?

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| 1. DNA Double helix model:
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1. How many base-pairs are represented in your piece of DNA? \_\_\_\_\_\_
2. What makes up the backbone of your DNA double helix candy model?
3. What makes up the backbone of an actual DNA double helix?
4. What makes up the rungs of your DNA double helix candy model?
5. What makes up the rungs of an actual DNA double helix?
6. What does “antiparallel” mean if we are talking about DNA?
7. What are the base-pairing rules (Chargaff’s Rule)?

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| 1. Nucleus with double helix and floating nucleotides:
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1. Which enzyme is responsible for cutting apart (or “unzipping”) the DNA? \_\_\_\_\_\_\_\_\_\_\_\_\_

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| 1. Replication:
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1. What enzyme is responsible for adding nucleotides to the growing DNA strand? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is the other role of this enzyme?

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| 1. 2 new DNA double helices:
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1. What kind of bonds form between the new nitrogenous bases? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What kind of bonds form between the new sugar-phosphate backbone? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What happens if an “incorrect” or “wrong” nucleotide is added?
4. Another major enzyme discussed in lecture that is involved in DNA replication was not represented in this lab. The name of this enzyme is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
5. What is the function of the above enzyme?
6. When does DNA replicate in the cell cycle?
7. What does complementary mean in terms of DNA?
8. What is the complementary strand of the DNA base sequence ATTCAGTTCCGA?
9. What is the complementary strand of the DNA base sequence CGATAGGACTTA?